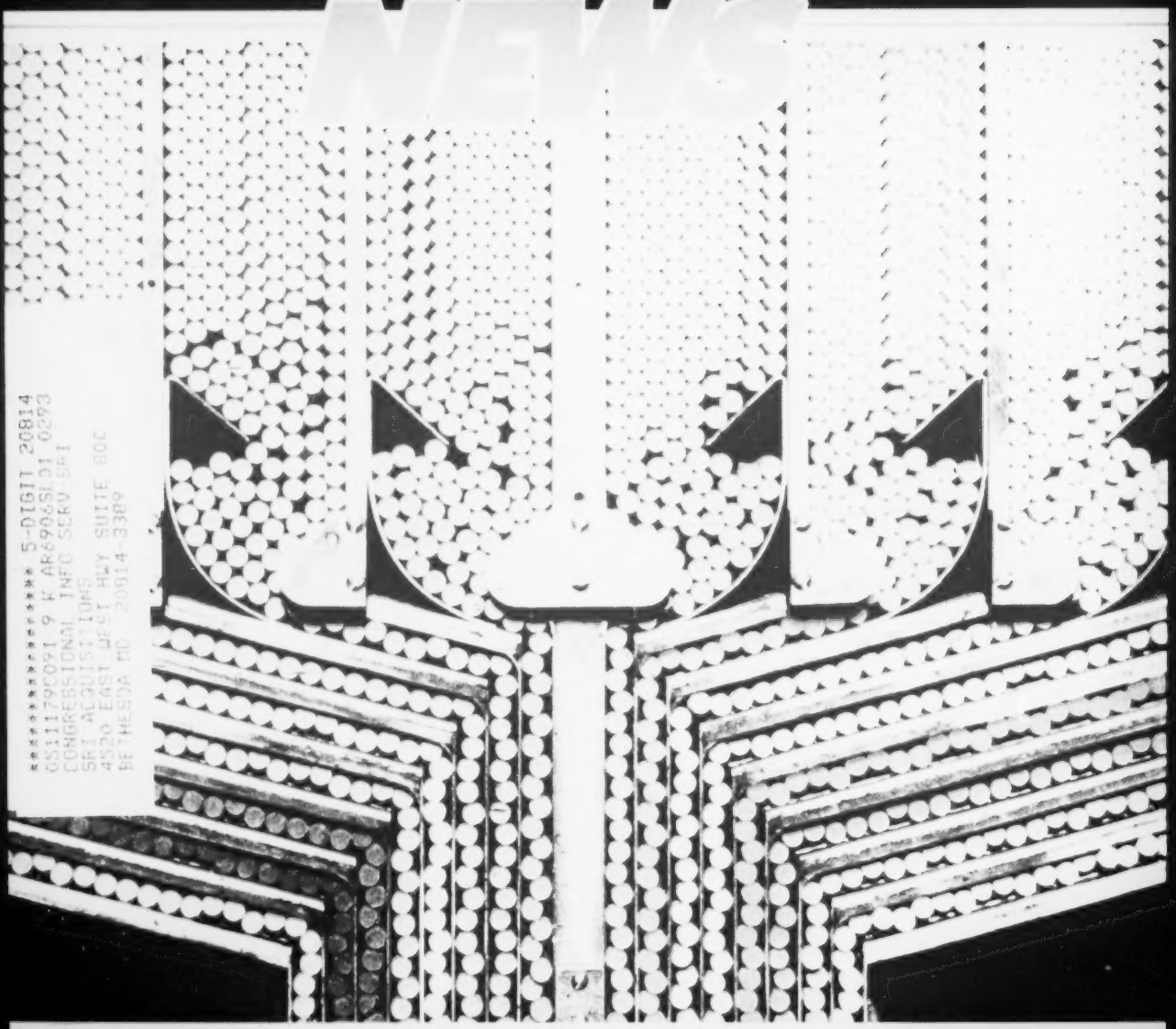
FEBRUARY 11, 1991
CHEMICAL & ENGINEERING

NEWS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Crayons

Ever-changing technology in colorful world of Crayola Page 19

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CHEMICAL & ENGINEERING NEWS

FEBRUARY 11, 1991

News of the Week

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- **IBM scientists develop technology to build "semiconductor lasers" opening up the possibility of making mass-produced, low-cost lasers.** Page 5
- **Cray Research and a consortium of major chemical and pharmaceutical firms introduce new computational chemistry software system aimed especially at industrial users.** Page 6
- **Bush Administration offers strategy for holding future U.S. greenhouse-gas emissions at or below 1987 levels.** Page 6

Business

Specialty chemicals business has lost some of its allure as companies now are finding that specialties can be hurt by such factors as economic downturn and maturing end-use markets. **Page 9**

Government

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U.S. corporate research directors fault management, financial pressures, for U.S. technology lag. **Page 14**

High-performance computing bill that would establish national research, education network seen as crucial to U.S. competitiveness. **Page 15**

Science/Technology

Blue daylilies and better guitars through physical chemistry are among intellectual pursuits of FSU's Michael Kasha, honored in recent conference on photoinduced proton-transfer dynamics. **Page 22**

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New study strengthens previously proposed link between excitatory dicarboxylic acids and neurodegenerative disorders. **Page 28**

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Cover: Crayon sorter at Binney & Smith Crayola manufacturing facility

Cover Story

Varied formulations of pigments, paraffin, and stearic acid have brought a wide range of new colors to a basic tool of schoolchildren, the Crayola crayon. **Page 19**

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LETTERS

CHEMICAL SAFETY

Alkyllithium reagents

Small fires caused by alkyllithium reagents (methyllithium, butyllithium, and *tert*-butyllithium) have been experienced in many chemical laboratories. The most disliked and dangerous work with these reagents is disposing of unwanted ones.

We have found that poly- or oligo(dimethylsiloxane) (PDMS or ODMS) is a useful reagent for deactivating alkyllithiums compared with the ordinary alcohols or other deactivating reagents. The advantages are: (1) No flammable gaseous by-product such as methane is generated. Alkyllithium compounds react with siloxane polymers to form cleaved polymers with alkylsilyl groups and lithium silanolate groups. (2) The basicity of the resulting lithium silanolate is weaker than that of corresponding lithium alcoholate. (3) The quenching reaction is mild; i.e., careful addition is not necessary.

A typical procedure is like this: Alkyllithium to be disposed of is added to a tetrahydrofuran solution of PDMS (Dow Corning 200 fluid 100 centistokes or its equivalent, known as "silicone oil" for oil baths; about 50% weight by weight solution, more than 100 g as PDMS to 1 mole of alkyllithium) and mixed for several hours. The solution is neutralized (if needed) by addition of acetic acid and discarded as a common organic waste material.

This method might seem expensive, but nothing is more expensive than a fire and subsequent explosion.

Toshio Suzuki
Research and Information Center
Dow Corning Japan Ltd.

A two-tiered faculty

It seems to me that American universities have extended themselves too much. At the undergraduate level, they attempt to be all things to all people. Since many entering students are inadequately prepared for college-level studies, most universities provide remediation at the freshman level. Since many graduate programs have emphasized research and deemphasized coursework, undergraduate curricula have had to incorporate additional material at the junior and senior levels. Another onus is the need to serve as a job-training center; thus the need to provide very specialized courses utilizing specialized equipment. This was not expected of the universities of the 1940s, 1950s, and 1960s.

At the graduate level, American universities have assumed the responsibility of doing much of this country's basic scientific research. Today's science faculty members are generally less professorial and more egotistical than were their counterparts in the earlier university system. It is not unusual for a chemistry faculty member at a large research university to teach only one or two courses each year! It is also typical for a research faculty member to be preoccupied with getting grants, publishing papers, and fattening his or her résumé. Graduate students are often thought of as just pairs of hands to do the mechanics of the research; undergraduate students are practically forgotten in the research shuffle. Professional research faculty are so engrossed in their research that they have little time to educate students.

This modern concept of university purpose—at both the undergraduate and graduate levels—began evolving in the mid- to late 1970s. Some results are obvious in the areas of science and technology. Today, graduating students are seldom generalists with a broad mastery of scientific concepts. They tend to be specialists with little or no expertise outside their narrow area of interest. They fit quickly into a specialized industrial or research job, but are not necessarily prepared to grow with the job. Persons educated at American universities in the 1940s, 1950s, and 1960s needed on-the-job training as provided by their employers. They brought to the job a general education involving ideas, theories, and problem-solving. They were not knowledgeable about what sequence of buttons must be pushed to operate a specific instrument, but they understood the general principles involved in the instrument's operation. Such people were able to grow and expand as their job duties expanded. Certainly, American industry and technology operated more efficiently and competitively then than now.

I offer the following suggestion as a

Specialty Chemicals Business Losing Some Luster

Demand growth, acquisition activity have slowed for some specialties buffeted by such factors as economic downturn, maturation of end-use markets

Susan J. Ainsworth, C&EN Houston

In the early to mid-1980s, specialty chemical businesses were too good to be true, promising continuous high performance and profits. So it was not surprising that so many companies were snatching up these specialty chemical gems at record pace and for record price tags, while others rushed to find ways to relabel a broad spectrum of chemical products as "specialty."

And indeed, specialty chemicals do have some advantages over commodity businesses that will help them weather the current recessionary storm and look to bright skies in the future. Especially well positioned will be companies in a select number of high-flying segments, such as the environmental area, with its certain, regulation-driven sales growth.

However, the industry's perceptions of specialty chemicals have come down to Earth over the past 10 years. Acquisition activity has mellowed and companies have come to realize that "specialties are subject to many of the same issues confronting those of the overall chemical industry, such as maturation of end-use industries and the characteristic pressures of the economic environment," says Larry D. Rosenberg, a director at Chem Systems, Tarrytown, N.Y., who spoke at a recent conference on "Competitive Advantage in the 1990s," sponsored by the consulting firm.

Sludge dewatering currently is fast-growing market for specialty chemicals

Looking ahead into 1991, "I don't see a rosy picture or a stellar increase in profitability" for specialty chemicals, says Karl D. Loos, managing director of Arthur D. Little's chemicals and plastics practice. Industry demand growth will be stagnant to slightly up over 1990 and profit margins will likely be compressed, he predicts. That means that the specialty chemicals business may grow only 3 to 4% per year, "just a little better than the gross national product," Loos adds. The boost that specialties got from electronic and high-tech areas in the last recession won't be there this time, he says. "Specialties will not get singled out as being recession-proof."

And most specialty companies don't expect to totally buck the recessionary trend. "We do not believe specialty chemicals are recession-proof," says John R. Webb, president of Exxon Chemical's performance products group. "When demand for our customers' products (often commodity in nature) falls off due to a recession, our process aid and product additive businesses are impacted—but generally not as dramatically as the commodity businesses.

"In specialties, we're basically in the problem-solving business. Lower profits in our customers' shop translate to their taking a very hard look at all their costs. In some cases, they may choose to live with their problems rather than try to solve them."

On the other hand, sometimes specialties can be something a customer

Fewer specialty companies are changing hands

Region	1989	1990	% change
U.S.	62	47	-24%
Western Europe	43	42	-2
Rest of world	15	15	0
TOTAL	120	104	-13%

Note: All figures for January through June periods only.
Source: CHEMTECH Industry Co.

may resort to getting into in a slow market environment, notes Walter F. Schlauch, group vice president for adhesives, resins, and specialty chemicals at National Starch & Chemical. If producers in an industry fall upon tough times, they may actually turn to a more specialized product—for example, something in the adhesive or paper businesses—if it will help them increase efficiency, he says. "But while a downturn in the economy can sometimes present an opportunity of this sort, I don't think that the negative impacts of a recession can be ignored by any means."

Certainly, the Middle East war has contributed to higher oil prices, which has led to higher raw material prices for specialty chemical producers. "Now oil prices are back down some, but oil-based raw materials prices have not come down as quickly," says Mary Kay Kaufmann, marketing manager for industrial water treatment chemicals at Nalco Chemical. "I don't know where raw material prices will level off," she adds.

Exxon Chemical's Webb says: "How the Middle East war will impact our businesses varies all over our product slate. High crude costs could hurt [profit] margins and demand in our paper chemical business, for example, but could benefit our oil field chemicals business since the high crude prices, if sustained, would encourage added production and mean more opportunities for us."

Nalco's Kaufmann adds: "There's a direct tie from how many wells are pumping to how much business we do" in the oil field chemicals area domestically. Last spring chemical consultants Kline & Co. estimated that the $680 million market for low-volume, high-priced oil field chemicals products would grow 6% per year between 1989 and 1994.

"In a scenario where you have high energy prices combined with recession, other specialties that are energy-savings driven also should do well," Webb says.

"And anything associated with the environment will show above-average industry growth," including environmental remediation products or services or environmentally friendly alternatives to existing products, points out Robert Henske, director of ADL's chemicals and plastics practice. The environmentally oriented specialty chemicals segment as a whole is growing roughly 6% a year, according to some estimates. But many of these niches are experiencing double-digit growth of about 15 to 20% per year, says Kaufmann. One such segment is sludge dewatering; an increasing number of industrial plants need to dewater the sludge that results from wastewater treatment processes to reduce the waste volume that will go into a landfill.

Indeed, Nalco is one company capitalizing on the environmental trend. "I would say that right now we believe that we are recession-proof," says Kaufmann. "Now, that's assuming that the recession does not come to the point where major businesses and industries are shutting down their operations like back in the early 1980s."

Cutbacks in the environmental controls area are rarely an option for customers, even when tough economic times abound, Kaufmann points out. Simply put: "Just because a recession hits, it does not mean you can start polluting."

The tightening noose of regulation means that more companies are being forced to clean up their industrial acts. This generates more opportunity for specialty chemical companies, particularly those who take a broad, flexible approach in responding to this trend. "In addition to providing new chemicals, suppliers will need to develop new systems and new technologies, in many cases, to meet the changing needs of their customers," according to the November/December 1990 issue of Stanford Research Institute's *Chemical Industries Newsletter*.

Webb: specialties not recession-proof

For example, last year Nalco teamed up with London-based Fuel-Tech N.V. to market its NOxOUT process, a cost-effective technology used to reduce nitrogen oxides produced by the combustion of fossil fuels from stationary sources such as industrial and electric utility plants. Tougher regulations on the emission of nitrogen oxides—which are a major ingredient in acid rain and ground-level ozone—likely will create "an excellent market for the technology," says Nalco.

Other companies are busy tapping the market for "environmentally friendly" products aimed to replace less desirable existing products. "These kinds of green products, while it is unclear how long their life will be, will be strong contributors to profitability at least over the next decade," says Loos.

For example, National Starch recently developed a cornstarch-based packaging material that can be a substitute for the widely used polystyrene "peanuts." The material, tradenamed Eco-Foam, dissolves readily in water. It leaves no toxic residue behind once it is decomposed, the company claims. No chlorofluorocarbon blowing agents are needed to make Eco-Foam loose fill. It is extruded in the same equipment and in much the same manner as some breakfast cereals and snacks—using a simple steam and heat system. Packaging material producer American Excelsior, Arlington, Tex., is the exclusive licensee for manufacture and distribution of the material in the U.S.

Beyond the environmental area, several other niches have been singled out to produce strong growth over the next few years. For example, Kline expects diagnostic aids to grow from a base of $3.08 billion in 1989 by 12% per year through 1994. For that same period, it forecasts low-volume, high-priced specialty

National Starch's new packaging material can be used in existing dispensing equipment

polymers to grow from a 1989 base of $3.05 billion by 9% per year; and electronic chemicals and specialty materials to grow from $3.40 billion by 8% per year.

Fewer companies have been relying on acquisition as a way to move or expand into lucrative specialty businesses. For the first half of 1990, acquisition activity in specialty chemicals was 13% below the corresponding 1989 level, according to Kline. According to CHEMTRAK, Kline's acquisition tracking service, a total of 104 transactions occurred in specialty chemicals in 1990, compared with 120 during the first six months alone in 1989. The largest decrease is in the U.S. where the number of acquisitions was down 24%. Meanwhile, Europe and the rest of the world have remained fairly steady, says Kline.

A decreasing number of U.S. specialty chemical companies may be changing hands because of a number of factors. First, the collapse of the junk bond market has made it difficult for many finance-driven acquirers to find sufficient financing, Kline conjectures. Another possible deterrent: uncertainties about the overall health of the U.S. economy.

Slower growth and a murky future for specialties mean that it may take longer to pay back premiums on acquisitions, so fewer companies are attracted to the acquisition route, Henske reasons.

Says Exxon Chemical's Webb: "Simply put, in 1989 and 1990 the price tags on potential acquisitions got too high. Right now, in today's economic climate, people are tending to be much more conservative. But it also can be a good time to buy, if the fit is right. We continue to have our eyes open for the right opportunities."

More companies are moving into specialties through a slow internal "evolution" process rather than the "revolution" of just buying into specialties through acquisition, notes Henske. "It's all part of the industry's quality programs where companies are learning more about who their customers are" and how they can more specifically meet their needs, which often involves performance-oriented chemicals and services that fall under the specialties guise.

Indeed, one of the major challenges for the 1990s will be increased competition even while demand in certain business segments shrinks. The forward integration of larger companies that are nontraditional specialty firms will make it harder to discern who is a specialty company and who is competition, says Loos.

Kaufmann: environmental markets provide double-digit growth

"The best way around the competition is to develop your own strategy of segmentation or differentiation. You have to look at your entire environment and carve out your particular niche," warns Abe Fenster, a general manager at ICI Americas, who spoke at the Chem Systems conference. "But be sure you have completely analyzed the market so that you really do carve a niche" rather than "dig a hole."

Keeping ahead of the competition in the laboratory and on a global scale will be no easy task. "For specialty companies, global competition and technological obsolescence will be among management's largest challenges" in the future, says Chem System's Rosenberg.

Companies continue to expand their geographical boundaries. But over the past two years, they have developed a clearer focus of what their positions are in specific regions of the globe, notes Schlauch. For example, rather then target individual countries, a company may adopt a more regional strategy designed for Europe post-1992 or a particular trading block, he adds.

Certainly, technological obsolescence is always a threat. The restructuring and downsizing of basic industries such as automotive and electronics is certainly not good news for specialties. "Along with these changes have been new, sometimes smaller and often specialized, requirements to meet the needs of these basic industries and other new ones that are formed, notes Rosenberg. Webb echoes that the specialty chemicals business is facing "more pressure from its customers to provide more sophisticated solutions and improved distribution systems."

Henske predicts products will have much shorter life cycles, so firms will need strong technical and R&D efforts to recoup and develop new products at a faster pace to meet demand. The companies that are successful at this game will not necessarily be the ones with the biggest R&D budget, but those that best manage those monies to ensure that they will be spent productively, he adds. "That will be one of the greatest challenges of the 1990s." □